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DEPARTMENT OF THE ARMY

U.S. ARMY TROOP SUPPORT COMMAND
NATICK RESEARCH, DEVELOPMENT AND ENGINEERING CENTER
NATICK, MA
01760-5019

REPLY TO
ATTENTION OF

STRNC-ITCP (700)

28 DEC 1989

MEMORANDUM FOR Commander, U.S. Army Medical Materiel Development Activity, ATTN: SGRD-UMB, FT Detrick, Frederick, MD 21701-5009

SUBJECT: Interim Progress Report on Arthropod Repellent Impregnant Project, April 1989 - December 1989

1. Reference phone communication between Bartley F. McNally, Natick, and COL Bernard Schiefer, USAMMDA on 1 Dec 89. Attached is a progress report on the Permethrin application project for the period April 1989 through December 1989.

2. Project Officer and point of contact for this action is Bartley F. McNally, AV 256-5468.

FOR THE COMMANDER:

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KENNETH A. REINHART
Director, Individual Protection
Directorate

CF:
PMCIE

PROGRESS REPORT ON PERMETHRIN REPELLENT IMPREGNANT PROJECT APRIL 1989 - DECEMBER 1989

Following are the statuses of the selected investigations into the application of Permethrin to Battle Dress Uniforms (BDUs).

1. Impregnation of Starch Treated BDUs with Permethrin

a. PROCEDURE

1. Seven Hot Weather BDUs, coat and trousers, were loaded into a field laundry and rinsed with clear water at 120 deg F for 30 seconds. Water soluble starch was applied at the 0.75% level for 5 minutes at 120 deg F. After starch application and extraction the BDUs were steam pressed in simulation of commercial laundering procedures. (The 0.75% starch level was chosen because it is the authorized level for "touch-up" pressing of BDUs).

2. Permethrin was then applied by the Individual Dynamic Absorption Application (IDAA) procedure. Laundry cycles of 0, 1, 10, 20 30, 40, 50 were completed in a field laundry. At the end of each designated cycle, one BDU, coat and trousers, was removed, extracted and samples taken for Gas Chromatographic (GC) Analysis.

3. The same procedure was followed for Temperate BDUs.

b. RESULTS

1. Application of Permethrin by IDAA appeared to be normal with uniform wetting of the fabric for both Hot Weather and Temperate BDUs.

2. The results as shown for the Hot Weather BDUs in Figure I and Table I were as anticipated by past work.

FIGURE I

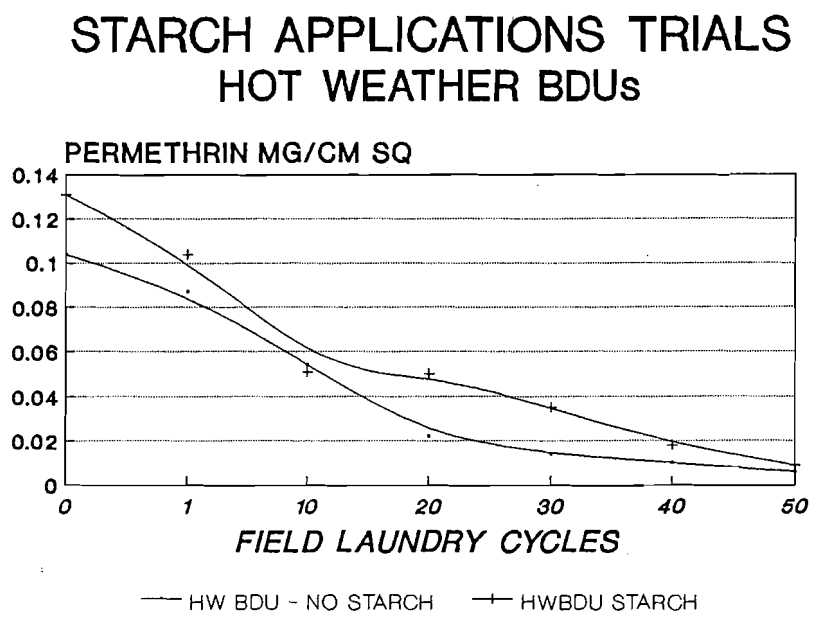

TABLE I
Impregnation of Starch Treated HWBDUs with Permethrin

	Field Laundry Cycles*						
	0	1	10	20	30	40	50
No Starch	0.104	0.087	0.054	0.022	0.014	0.010	0.006
Starch - 0.75%	0.131	0.104	0.051	0.050	0.035	0.018	0.009

* Values are in mg/cm sq

3. The results as shown for the Temperate BDUs in Figure II and Table II were a departure from the norm in that each wash level showed a much higher Permethrin retention level that has been previously experienced. **The Permethrin retention level with starch at 50 cycles was 5 time greater than the retention level without starch at 50 cycles.**

4. To test the possibility of experimental error the complete procedure of starch, impregnation with Permethrin, and laundry cycles was repeated with fresh Temperate BDUs. Figure II and Table II show the retention level for the repeat trial was even higher than the original trial. After 50 cycles the retention level was almost 1/2 the original application level.

FIGURE II

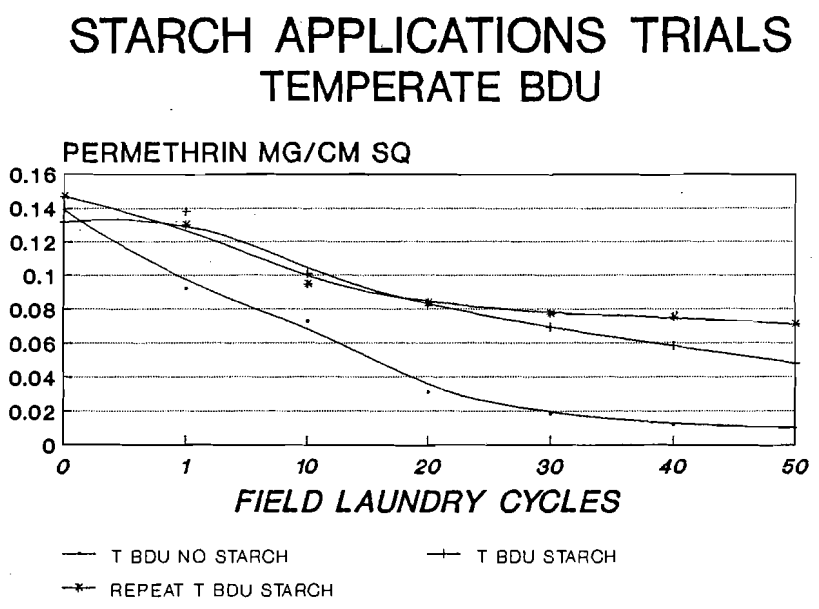

TABLE II
Impregnation of Starch Treated TBDUs with Permethrin

	Field Laundry Cycles*						
	0	1	10	20	30	40	50
No Starch	0.139	0.092	0.073	0.031	0.018	0.012	0.010
Starch - 0.75%	0.132	0.138	0.101	0.082	0.069	0.058	0.048
Rep Starch-0.75%	0.147	0.130	0.095	0.084	0.077	0.075	0.071

* Values are in mg/cm sq

2. Laundering of Permethrin Treated & Untreated BDUs

a. PROCEDURE

Two sets of Temperate BDUs, coat and trousers, were impregnated with Permethrin at the 0.125 mg/cm sq level by the Individual Dynamic Absorption Application (IDAA) method. Together with two sets of untreated Temperate BDUs, coat and trousers, they were laundered for 10 cycles in a field washer.

b. RESULTS

There appears to be no significant transfer of Permethrin from treated to untreated during laundering. GC results are shown in FIGURE III and TABLE III.

FIGURE III

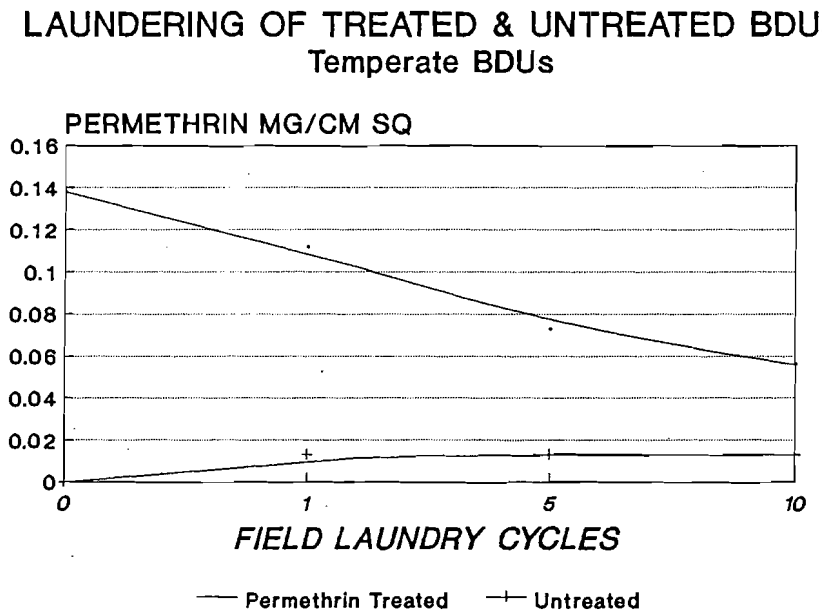

TABLE III
Transfer of Permethrin During Laundering of Treated & Untreated BDU

	Field Laundry Cycles*			
	0	1	5	10
Treated	0.138	0.112	0.073	0.056
Untreated	-	0.013	0.013	0.013

* Values are in mg/cm sq

3. **Water Leaching**

a. PROCEDURE

Samples of Permethrin treated BDUs were subjected to a standardized continuous water immersion at 80-85 deg F for 24 hrs.

b. RESULTS

No significant loss of Permethrin was experienced during the water leaching trials. GC results are shown below.

FIGURE IV

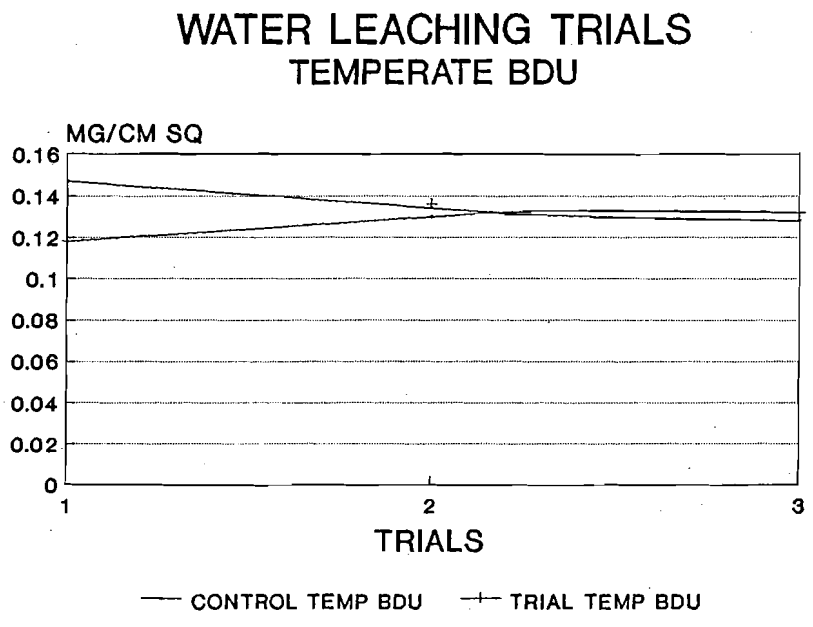

FIGURE V

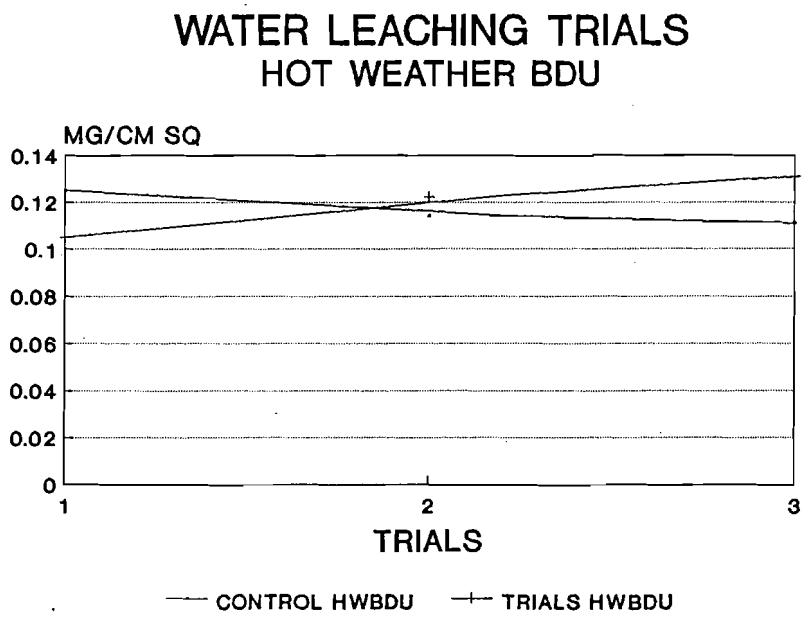

TABLE IV Water Leaching Trials Data

	Trials		
	1	2	3
Temperate BDU			
Control	0.147	0.130	0.128
Trials	0.118	0.136	0.132
Hot Weather BDU			
Control	0.125	0.114	0.111
Trials	0.105	0.122	0.131

* Values are in mg/cm sq

4. Tents and Tent Accessories

a. PROCEDURE

Candidates for Permethrin treatment fall into four (4) categories.

a. General Purpose tents - cotton duck, normally treated with fire retardant, water, wind repellent and mildew inhibitor.

b. Temper tents - modular, polyester base fabric with light coating of polyvinyl chloride. Normally treated with Fire Retardant.

c. Boat Sateen - Arctic, 5 and 10 man only. Normally treated with Fire Retardant.

d. Tent liners - cotton, normally treated with Fire Retardant, Mildew Inhibitor.

Items in all of the above categories are presently treated as indicated by contractors. Samples of Permethrin were sent to various contractors to determine compatibility with Fire Retardant, Water, Wind Repellent, and Mildew Inhibitor formulations.

The Natick investigator visited a contractor in each category and processed yardage with the formulation containing Permethrin at a target level of 0.125 mg/cm sq.

b. RESULTS

Initially, the participating contractors reported that Permethrin was compatible with all treatments in all tent categories. Armed with this information the Natick investigator visited two contractors and processed sample yardage of tent fabric in each category. No problems were encountered during the processing; Permethrin was completely compatible with all formulations.

5. Effect of Extreme Temperatures on Stability of Permethrin

a. PROCEDURE

In accordance with AR70-38, Research, Development, Test and Evaluations of Material for Extreme Climatic Conditions, the stability of Permethrin was investigated at -70 deg F and +160 degrees F.

Individual samples were placed in a controlled deep freezer at -70 deg F and in a controlled convection oven at +160 deg F. Monthly samples were drawn over a period of six months.

b. RESULTS

The low temperature samples showed some deterioration after two months. The high temperature samples showed variable deterioration up to 16.9% with the first month showing the most deterioration. It is not known if the deterioration is statistically significant at this time.

FIGURE VI

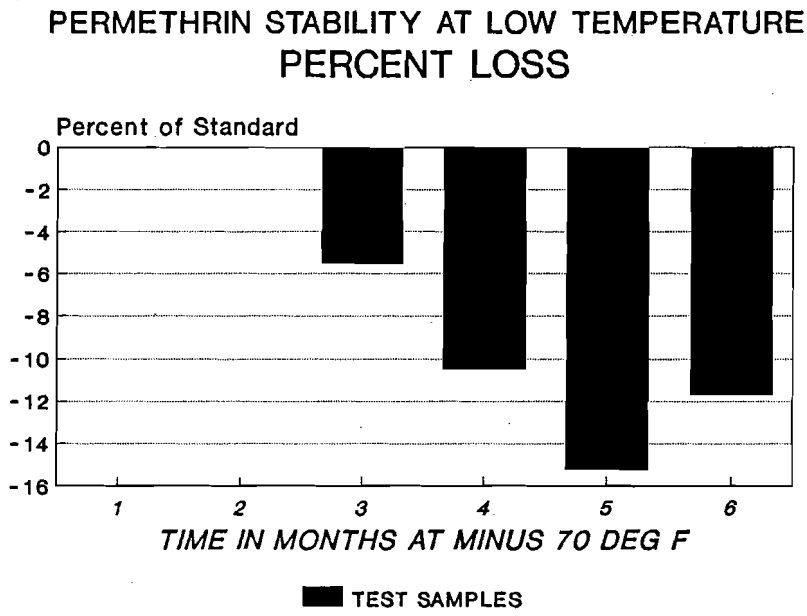

TABLE V
Permethin at -70 deg F Data

	Months					
	1	2	3	4	5	6
Low Temp Samples*	0.0	0.0	-5.5	-10.5	-15.2	-11.7

* Values expressed as percent loss of a standard sample of Permethrin

FIGURE VII

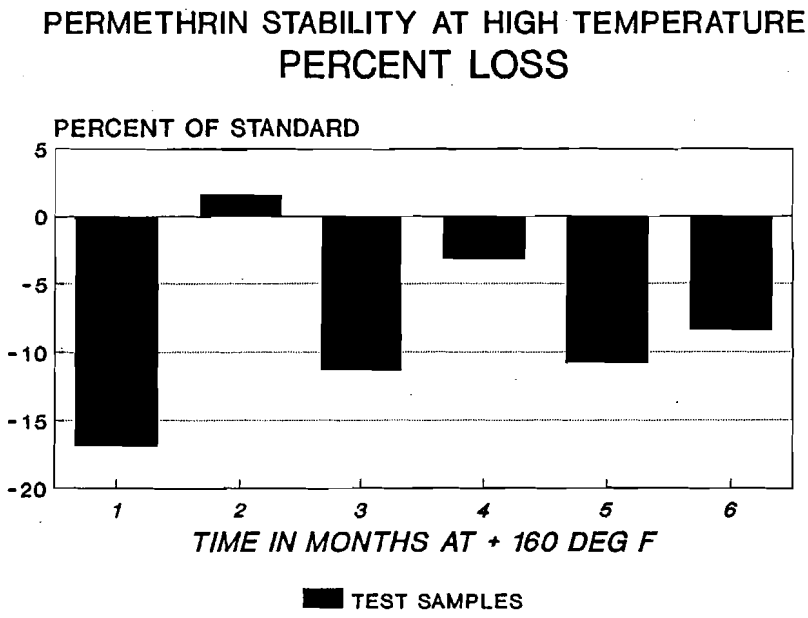

TABLE VI
Permethrin at +160 deg F Data

	Months					
	1	2	3	4	5	6
High Temp Samples*	-16.9	+1.66	-11.3	-3.17	-10.8	-8.4

* Values expressed as percent loss of a standard sample of Permethrin

6. **Permethrin Procurement Description**

a. PROCEDURE

Draft procurement description for Permethrin 40EC, (35:65 cis:trans) in 9 ml, 151 ml, 1 gallon, 30 gallon units.

b. RESULTS

A procurement specification is currently under development in Natick's Technical Data Package Development Branch.

7. **IDAA Kit Procurement Description**

a. PROCEDURE

Draft procurement description for IDAA kits.

b. RESULTS

A Commercial Item Description (CID) was developed for the IDAA kit and distributed to other agencies for coordination. The Armed Forces Pest Management Board recorded a nonconcurrence and suggested that the CID be converted to a military specification. The specification is currently being developed.

8. **Treatment Marking of BDUs**

a. PROCEDURE

Develop a marking system for BDUs to date identify when BDUs received initial Permethrin treatment.

b. RESULTS

A. Marktex-Texpen #3, black, has been selected for inclusion in the IDAA field package (one pen per 12 IDAA kits). Instructions in the kits are: "After treatment mark the inside coat collar and the inside waist band 'Perm treat, mm/yr'" The ink and marking will remain up to and beyond fifty launderings.

9. **Wash Water**

a. PROCEDURE

Determine the parts per million of Permethrin in laundry wash water when treated BDUs are washed in a home laundry.

Hot Weather & Temperate BDUs were treated with Permethrin at 0.125 mg/cm sq target level and laundered separately for 1, 2, 3, 4, 5, 10, 20, 30, 40, 50 cycles. Two samples of the wash water after each cycle was taken for GCs.

b. RESULTS

All necessary samples were taken. When GCs' were attempted on the samples, erratic results were obtained. Apparently interference by the water and/or detergent caused the erratic results. A new procedure to deal with the interference has been worked out; but, a few more months will be required to produce acceptable results.